MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2018/2019

BMT1014 –MANAGERIAL MATHEMATICS

(All sections / Groups)

26 OCTOBER 2018
3 p.m - 5 p.m
(2 Hours)

INSTRUCTIONS TO STUDENT

1. This Question paper consists of **8 pages** including cover page and mathematical formulas with **4 Questions** only.

2. Attempt **ALL** questions and write your answers in the Answer Booklet provided.

3. The candidate is allowed to use scientific calculators that are permitted to be used in the examination.

Question 1 (25 marks)

(a) Solve the quadratic-form equation $-6x^2 + 15x + 36 = 0$.

[6 marks]

(b) Solve by rationalizing the denominator $\frac{2}{\sqrt{2}-6}$.

[6 marks]

(c) Solve the following pair of simultaneous equations using either the substitution or the elimination method:

$$4x + 5y = 21 ,$$
$$6x + 3y = 27$$

[5 marks]

(d) A bicycle manufacturer experiences fixed monthly costs of $124,992 and variable costs of $52 per standard model bicycle produced. The bicycles sell for $100 each.

(i) If C dollars is the cost from selling x bicycle, write down a formula which relates C to x.

[2 marks]

(ii) How many bicycles must he produces and sell each month to break-even?

[3 marks]

(iii) What is his total revenue at the point where he breaks-even?

[3 marks]

Continued...

Question 2 (25 marks)

The Victory Fresh Drink makes 2 type of drinks; Strawberry and Lemonade and deliver them to three different shops. Each shop sells:

Shop A:	4 packs of Strawberry drinks and 1 pack of Lemonade drinks
Shop B:	3 packs of Strawberry drinks and 15 packs of Lemonade drinks
Shop C:	3 packs of Strawberry drinks and 4 packs of Lemonade drinks

In total, Shop A must sell at least 12 packs of drinks, Shop B at least 44 packs of drinks and Shop C at least 22 packs of drinks each day.

Let x be the number of Strawberry Drink produced by Victory Fresh Drink
y be the number of Lemonade Drink produced by Victory Fresh Drink

The information can be expressed as five inequalities.

$$4x + y \geq 12$$

$$3x + 15y \geq 44$$

$$3x + 4y \geq 22$$

$$x \geq 0$$

$$y \geq 0$$

(a) The cost of producing Strawberry Drink is \$3 per bottle and \$2 per bottle for Lemonade Drink. Write down the objective function for minimizing the total daily cost value.

[2 marks]

(b) Using all the inequalities given, construct a graph and shade the feasible region. Label all corner points clearly.

[14 marks]

(c) Find the number of units for each type of drinks that should be produced each day, in order to minimize the total cost – justify your answer. What is the minimum cost?

[9 marks]

Continued…

Question 3 (25 marks)

(a) A computer with the price of \$2000 can be bought using hire purchase with a deposit of \$200 and the balance being financed at 12% simple interest over two years. Find the total amount paid for the computer.

[5 marks]

(b) A \$20,000 loan is amortized by equal quarterly payments over 4 years. If interest is at rate of 8% compounded quarterly, find the quarterly payment.

[6 marks]

(c) Find the interest obtained over three years when \$25,000 is invested 7% per annum with interest compounding on a half yearly basis.

[4 marks]

(d) A television set costing \$880 can be bought for no deposit with weekly repayments of \$10 over two years. Find the effective rate of interest per annum on this deal.

[5 marks]

(e) Sarah plans to put \$1500 per quarter into her retirement account until she retire 25 years from now. If the account earn interest at the rate of 8% per year compounded quarterly, how much will Sarah have in her account at the time of her retirement?

[5 marks]

Continued...

Question 4 (25 marks)

(a) Differentiate the following functions using product rule and quotient rule:

(i) $y = x^3(4-x)^{\frac{1}{2}}$ [4 marks]

(ii) $y = \frac{x^2}{2+x}$ [4 marks]

(b) Find an equation of the tangent line to the following curve at the indicated point:

$$y = \frac{x^2 - 5}{6}; \qquad (-1,2)$$

[4 marks]

(c) Integrate the following functions:

(i) $\int \left(\frac{-x^9 - 3x^6 - 7x}{x^3} \right) dx$ [4 marks]

(ii) $\int_{-2}^{1} (x-3) \; dx + \int_{1}^{2} \frac{9x^2}{\left(x^3-3\right)^2} \; dx$

[6 marks]

(d) Find partial derivatives $f_x(x,y)$ and $f_x(1,2)$ for $f(x,y) = xy^2 + x^2y$.

[3 marks]

End of Page.

Course: Managerial Mathematics
Code: BMT 1014

Summary of Principal Formulas and Terms

1. Quadratic Formula

The solution of the equation: $ax^2 + bx + c = 0$ where $a \neq 0$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

2. Equation of a Straight Line

(i) Slope of a line, $m = \frac{y_2 - y_1}{x_2 - x_1}$

(ii) Point-slope form, $y - y_1 = m(x - x_1)$

(iii) Slope-intercept form, $y = mx + b$ (where m = slope, b = y-intercept)

(iv) General form, $Ax + By + C = 0$

3. Simple Interest

(i) Interest, $I = Prt$ (P = principal, r = interest rate, t = number of years)

(ii) Accumulated amount, $A = P(1 + rt)$

4. Compound Interest

(i) Accumulated amount, $A = P(1+i)^n$, where $i = \frac{r}{m}$, and $n = mt$

(m = number of conversion periods per year)

(ii) Present value for compound interest, $P = A(1+i)^{-n}$

5. Effective Rate of Interest

$$r_{eff} = \left[1 + \frac{r}{m}\right]^m - 1$$

6. Future Value of an Annuity

$$S = R\left[\frac{(1+i)^n - 1}{i}\right]$$ (S = future value of ordinary annuity of n payments of R dollars periodic payment)

7. Present Value of an Annuity

$$P = R\left[\frac{1 - (1+i)^{-n}}{i}\right]$$ (P = present value of ordinary annuity of n payments of R dollars periodic payment)

8. Amortization Formula

$R = \dfrac{Pi}{1-(1+i)^{-n}}$ (R = periodic payment on a loan of P dollars to be amortized over n periods)

9. Sinking Fund Formula

$R = \dfrac{Si}{(1+i)^{n}-1}$ (R = periodic payment required to accumulate S dollars over n periods)

10. Basic Rules of Differentiation

(a) Derivative of a constant: If $f(x)$ is a constant, then $f'(x)=0$

(b) Power rule : If $f(x)$ is x^n, then $f'(x)=nx^{n-1}$

(c) Constant multiple rule: Derive $cf(x)=cf'(x)$ (c is a constant)

(d) Sum rule: Derive $f(x)\pm g(x)=f'(x)\pm g'(x)$

(e) Product rule: If $f(x)=u\times v$, then $f'(x)=u\dfrac{dv}{dx}+v\dfrac{du}{dx}$

(f) Quotient rule: If $f(x)=\dfrac{u}{v}$, then $f'(x)=\dfrac{v\dfrac{du}{dx}-u\dfrac{dv}{dx}}{[v]^2}$

(g) Chain rule: Derive $g[f(x)]=g'[f(x)]f'(x)$

(h) General power rule: Derive $[f(x)]^n=n[f(x)]^{n-1}f'(x)$

(i) Exponential function: Derive $e^x=e^x$

Derive $(e^u)=e^u[u'(x)]$

(j) Logarithmic function: Derive $\ln x=\dfrac{1}{x}$

Derive $(\ln u(x))=\left(\dfrac{1}{u(x)}\right)[u'(x)]$

11. Basic Rules of Integration

(a) Indefinite integral of a constant: $\int k\ du = ku + C$

(b) Power rule: $\int u^n du = \dfrac{u^{n+1}}{n+1}+C$

(c) Constant multiple rule: $\int kf(u)\ du = k\int f(u)\ du$ where k is a constant

(d) Sum rule: $\int [f(u)\pm g(u)]\ du = \int f(u)du + \int g(u)du$

(e) Exponential function: $\int e^u du = e^u + C$

(f) Logarithmic function: $\int\left(\dfrac{1}{u}\right)du = \ln u + C$

12. Definite Integrals

a) The fundamental Theorem of Calculus:

Let f be continuous on [a,b], then,

$\int_a^b f(x)\,dx = F(b) - F(a)$ where F is any antiderivative of *f*; that is $F'(x) = f(x)$

b) Area between two curves:

Let *f* and g be continuous functions such that *f(x)* $\geq$ *g(x)* on the interval $[a,b]$. Then the area of the region bounded on $[a,b]$ is given by $\int_a^b [f(x) - g(x)]\,dx$.

13. Determining Relative Extrema

$$D(x,y) = f_{xx} f_{yy} - (f_{xy})^2$$

If D > 0 and $f_{xx} > 0$, relative minimum point occurs at (x, y).
If D > 0 and $f_{xx} < 0$, relative maximum point occurs at (x, y).
If D < 0, (x, y) is neither maximum nor minimum.
If D = 0, the test is inconclusive.